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IMPACT ON THE ENVIRONMENT DUE THE CONSTRUCTION OF THE SEWAGE TREATMENT PLANT AND SEWAGE SYSTEM IN TÂRGU-JIU, GORJ COUNTY

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Abstract: The construction or upgrading of a sewerage system and a sewage treatment plant can have a negative impact on the environment. That is why it is very important to study the impact these modernization works have on the environment. These works are needed to improve the standard of living of the population, but, however, if this impact is negative, the necessary steps must be taken to eliminate these effects. The purpose of a station is to clean up the wastewater and industrial wastewater in the city and to return the emissary to certain parameters admitted by European standards. The process of purification technology is particularly complex. Wastewater is the major source of pollution that causes a large variety of microbes, viruses and infectious diseases to emerge. This paper aims to study the impact of the development or modernization of a wastewater treatment plant in this city.

Keywords: sewage, environment, sources of pollutants

1. INTRODUCTION

In Gorj County, it was found that the majority of economic agents reduced the discharged water flows, compared to the authorized flows, as a result of reducing or restricting the economic activities. Due to this aspect, the main economic agents have not permanently exceeded the quality indicators, compared to the limits allowed by the water management regulations.

Wastewater treatment plants are in an advanced degree of physical and moral wear, with insufficient water treatment capacity for wastewater flows. Most sewage plants do not achieve regulated qualitative parameters, releasing inadequately drained water in the watercourses. A major problem is the direct discharges of untreated water due to the lack of purification stations [1].

The reasons for the inadequate operation of the wastewater treatment plants are their under-dimensioning, physical wear and tear and negligence in operation.

Purpose of modernization of the treatment plant

- By implementing the works provided in this documentation, it is intended:
- Solving the problems related to collection and directing to the sewage treatment plant in Târgu Jiu Municipality;
- Protection of water-soil environmental factors by creating a network of sewage collectors with new, modern, high-sealing materials;
- Reduction of operating costs through better network management, pumping and maintenance costs;
- Increasing the safety of the operating personnel;
- Improving the living conditions of the population of the municipality;
- The social and economic development of the area through the possibility of attracting new investors by offering a modern and functional infrastructure;

Location in the environment

Târgu Jiu is located in Gorj County, at the intersection of the 45 ° latitude parallel with the 23 ° east longitude meridian. The parallel 45 ° latitude that passes through the city demonstrates the settlement of Tg-Jiu on Globe, equidistant from the Equator and the North Pole, in a temperate zone.

The city stretches over 13 km from north to south and 10 km from east to west on both sides of Jiu. It occupies a central position in the county of Gorj and is bordered to the north by the communes: Stăneşti, Turcineşti and Bumbeşti-Jiu; to the east with the communes: Bălăneşti and Bălăneşti; to the south with the communes: Dăneşti and Drăguţeşti; and to the west the villages of Băleşti and Leleşti [1].

From a morphological point of view, Târgu Jiu municipality is located in the geographic area of Getic Subcarpathians, in the Târgu Jiu - Câmpu Mare Depression, one of the largest intracolinary subcarpathian depressions. Located in the western part of the Getic Subcarpathians, the depression is bordered to the north by the Gorj Deal (internal Carpathian hills), and to the south of Bran Hill (333 m, external hill); to the east it stretches to Gilort, and west to Motru. The depression has low altitudes for a sub-Carpathian region (less than 300 m), it is crossed

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by Jiu and has the appearance of a "big field" (hence the name of Câmpu Mare).

The medium and minor relief, overlaid over the major one, is represented by valleys, terraces, meadows and slopes, on the surface of which sometimes landslides occur. The valleys are mostly transverse to the hills.

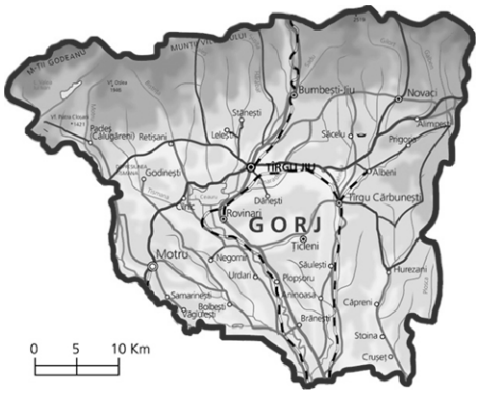

Figure 1. County map Gorj

Elements of geology and soil

From a geological point of view, the studied site belongs to a moose area, namely Getic Depression.

This unity stretches out to the Southern Carpathians, forming a depression born through the sinking of a crystalline area, which was held by the Carpathians and connected to them by the Balkans.

The units that make up the Târgu Jiu - Câmpu Mare depression are generally composed of sedimentary soft rocks from Pliocene (clay, gravel, sands and rarer sandstones), over which there is a pavement of Carpathian gravel.

As an evolution, they formed at the end of the alpine oogenesis (in the Quaternary), through mild crunching of the layers, but above all through upward movements.

In Gorj County, various soils are located, due to the conditions of relief, dominantly fragmented, rock, climate and vegetation (560,174 thousand ha). In the piedmont area and in the southern sub-Carpathian hills dominate the underground soil, in association with brown soils. Mountain soils are usually skeletal and have low thickness [2].

Alluvial soils (about 62 thousand hectares) appear on the broad meadow of Jiu and its tributaries.

The surface occupied by eroded soils amounts to approx. 81 thousand ha (of which about 19 thousand ha with landslides), and the soils with danger of erosion approach 340 thousand ha, of which with agricultural use approx. 110 thousand ha.

The soil conditions, and especially the highly fragmented relief, do not allow the extensive use of soil in the agriculture (with the exception of the sub-Carpathian and the Meadow), so that the forestry use has a greater share.

2. IMPACT ASSESSMENT ON THE ENVIRONMENT

2.1 Potential sources of pollutants during execution

2.1.1. Potential sources of pollutants for water

Permanent sources of pollutants for groundwater and surface waters (emissaries) do not exist during the execution period. Surface spraying and groundwater contamination sources may occur in the event of accidental leakage of oil products from construction machinery and equipment (trucks, dumpers, tractors, compressors, etc.).

Groundwater and surface water may also be polluted by suspended spillages from meteoric waters from the sewer pipe laying sewers and from the sewage treatment plant. These categories of pollutants have low concentrations, with insignificant effects on water resources.

2.1.2. Sources of air pollutants

Air pollutants during sewage works are: dust, noise and exhaust gases from construction equipment (trucks, dumpers, tractors, compressors, compactors, etc.).

Dust is the result of the movement of machinery and construction equipment from digging, land and ballast spraying, compaction, and construction work.

Exhaust gases and noise result from construction machinery and equipment.

Reducing these sources of pollution can be achieved by spraying work areas, using high-performance machines, or by using screens to protect areas where they work.

2.1.3. Sources of noise and vibration

The noise and vibration sources produced during the construction period come from the construction machinery and the car traffic.

The noise level is approx. 85 - 95 dBA.

Noise comes from construction equipment, lasts 8 hours in winter and 10-12 hours in summer, and is of low frequency.

The minimum distance to the protected receiver is 300 m for the treatment plant.

According to STAS 10009/2008 [4] the permissible value at the building perimeter limit is less than 50 dBA to the nearest protected receptor.

2.2. Sources of pollutants during the exploitation period

Emissions of pollutants into the environment resulting from the technological processes of the treatment plant and related activities to be carried out within the station are:

- waste and sewage sludge, grates and grease separators;
- emissions of gases into the atmosphere;
- noise and vibration of the machines [3].

2.2.1. Emissions of pollutants for water and protection of water quality

Sources of pollutants for groundwater and surface waters are:

- sewage seepage through leakage of joints from sewers or their connection to the sewers;

Concentrations and mass flows of pollutants from domestic sewage at the entrance to the treatment plant are shown in the table (Table 1).

Table 1. Concentrations and mass flows of pollutants

Source	Pollutant (kg/day)	Mass flow (kg/day)	Concentration (mg/l)
Sewerage	MTS	175	259,06
	C_{BO5}	162, 5	240,56
	NH_4	27,5	40,71
	P_{tot}	6,25	9,25

The wastewater discharge conditions in the Cerna brook, according to the water management opinion and NTPA 001/05 [1] have the values shown in the table (Table 2).

Table 2. Values admitted to the exhaust

Water category	Quality indicators	Values admitted (mg/l)
Waste water	MTS	60
	CBO_5	20
	Ammoniac nitrogen	2
	Total phosphorus	1

2.2.2. Sources of pollutants in the air. Concentrations and mass flows of pollutants resulting from technological and activity phases

a) Sources of air pollutants

Air pollutants from the treatment plant result from fermentation of sludge at:

- Inhofe decanters;
- secondary decanter;
- sludge stabilization basins;
- sludge platforms.

The resulting emissions are: CH4, NH3, H2S and mercaptan.

b) Concentrations, mass flow rates of emissions produced and emitted in the environment

Concentrations of emission pollutants can not be calculated because the sources do not have exhaust sections. Pollutants diffuse directly into the ground atmosphere.

Ammonia that is evacuated into the atmosphere has a short life of 28 to 54 hours and reacts with acidic compounds in the atmosphere (HNO3, H2SO4). It is resulting neutral and mildly acidic salts, aerosolized ammonium sulphate. Another pollutant that appears is formaldehyde (HCHO). Between methane and formaldehyde, conversion reactions occur, but it is not possible to establish an HCHO formation rate and the mass flow cannot be determined.

3. IMPACT ON THE ENVIRONMENT

3.1. Impact produced during the execution period

3.1.1. Description of the execution works

The sewerage works being carried out are made up of: the sewerage network; a sewage plant and a sewage treatment plant; sludge drying platforms; the mouth of the spill in the Lupac brook and the exploitation pavilion which is a brick-built ground floor building.

The fitting works consist of excavation, filling, concrete and metal constructions, installation of machinery, works for canals and pipelines, electrical installations, etc.

The underground water in the area of Teliuc may be partially affected by construction works for sewage and sewage works. The surface water in the area of the Cerna stream site is partially affected by the meteoric water leakage through the sewerage network and the purification plant objects [4]. .

Impoundment of groundwater and surface water may occur due to accidental leakage from construction machinery and equipment, leakage that can be avoided by using high performance machinery and equipment.

The excavation works will be carried out in order to achieve the objective, the transport of the earth, concrete, machinery, etc. involving the use of heavy-duty vehicles, bulldozers, excavators, cranes, etc. The resulting nose will be: NOx, CO, SO2, volatile organic compounds, smoke, particles, etc. The main polluter will be the dust that will be released during the excavation, loading and transportation of the earth. Air Pollution Air Pollution is short-lived, limited in time (runtime).

The sound polluter during execution will be released from the machines and means of transport but will not exceed 70 dBA and the nearest receiver will be 50 dBA.

Execution activities do not produce vibrations.

Construction works within the treatment plant affect the environment to a limited and limited extent.

During the construction work, the soil factor is strongly modified by scraping, digging, but the change takes place for a short period of time. After completion of the works, the soil will return to its characteristics before the work begins.

3.2 THE IMPACT OF THE PRODUCT IN THE OPERATING PERIOD

3.2.1. Impact on water

a) Pollutant dispersion in water, extent and qualitative changes in natural receptors, including groundwater.

b) Effect on aquatic ecosystems and water use

The suspended matter is deposited in the bed of the brook, consumes the oxygen from the water and produces clogging. Organic substances and microorganisms consume oxygen from water. Water in the water is not allowed to fall below 4 mg / l. Oxygen is necessary for the existence of aerobic organisms, for the oxidation of organic substances. Pollution of waters with phosphorus and nitrogen is

due to the intensive use of fertilizers. Underground waters are polluted with nitrites and nitrates, surface waters with ammonia and phosphates.

Pollutant concentrations in treated waters fall within the limits of the discharge conditions required by NTPA 001-05 [1].

If during the operating period the purification is carried out properly, the water will not be polluted

3.2.2 The impact on air

The air environment factor is not affected, so the atmosphere cannot affect other environmental factors. The atmosphere is best propagated by pollution, affecting the human factor and all other elements of the environment. Water can be affected by washing the pollutants with rainwater and reaching the surface waters and groundwater. Soil can be affected by pollutants by depositing it on the soil and washing the precipitation pollutants in the soil.

Vegetation can be affected by the deposition of pollutants (e.g. acid rain).

Effects of pollutants in the air

Ammonia and formaldehyde are compounds that create discomfort and have irritating effects. Ammonia inhalation in large quantities may cause suffocation and the airways may be affected. Formaldehyde has carcinogenic effects in animals, humans have not yet been detected cases.

Effects of noise

Hearing impaired may result from the effects of noise. The action of noise affects the whole body, it penetrates not only in the ear, but also through the skin, muscles, bones, joints, etc. It is highly influenced by the central nervous system.

Changes in the hypothalamic pituitary system that have effects on: the cardiovascular system by accelerating the pulse, increasing the blood pressure, the respiratory system responds by accelerating the pulse and the frequency of the respiratory amplitude as well as the oxygen consumption, the digestive system exhibits inhibitory secretion changes. The endocrine system suffers from the noise level, there are disorders of the thyroid gland.

3.2.3 Assessing the risk of accidents or damage having a major impact on the health of the population and the environment

Risk situations may arise from accidental spillage from the existing low-power industry or from the interruption of electricity and thus the biological stage does not achieve aeration and the degree of purging is not achieved. The objects in the sewage plant provide waste water storage to help remedy the fault.

Ensuring a double power supply raises very high costs. In case of non-operation of the biological step there is a risk of increased pollution of Cerna brook. Such a situation can be avoided by equipping the station with an electric generator like
double power source.

The Cerna brook, being damped in the site, makes the sewage station not flooded in torrential rains.

4. IMPACT ASSESSMENT

4.1 Impact Assessment Using Pollution Indices (Ip) (V.Rojanschi)

I_p pollution indices:

$$I_p = C_{max}/C_{adm}$$

Where:

C_{max}= maximum concentration of the pollutant

I_p=0-1 - the environment is affected within acceptable limits and the effects are positive or negative without being harmful;

I_p>1 - the environment is affected beyond the permissible limits, the admitted effects are evaluated depending on the degree of overcoming;

Valuation notes for the value of the pollution indices I_p are presented in table 3.

Table 3. Notes of creditworthiness

NC	I_p	Effects on humans and the environment
10	0	- the medium unaffected by unana activity - the state of the natural environment
9	0÷0,2	- the environment affected by human activity - without quantifiable effects
8	0,2÷0,5	-the environment is affected within acceptable limits, level 1 - reduced environmental impacts
7	0,5÷1,0	-the environment is affected within acceptable limits, Level 2 - the effects are high
6	1,0÷2,0	- the medium is affected beyond the admitted level, level 1 - the effects are high
5	2,0÷4,0	- the environment is affected beyond the limits, level 2 - the effects are harmful
4	4,0÷8,0	- the environment is affected beyond the admitted level 3 - harmful effects are highlighted
3	8,0÷12,0	- degraded environment, level 1 - effects are lethal at average exposure times
2	12,0÷20,0	- degraded environment, level 2 - effects are lethal at short exposure times
1	>20,0	- the environment is unfit for life

4.2 Impact assessment using pollution indices (Ic)

The I_c quality index that relates to the magnitude of the effects.

$$I_C = \frac{1}{\pm E}$$

E > 0 - positive influence on the environment;

E < 0 - the negative influence on the environment;

E = 0 - it has no influence on the environment;

I_C = 0 ... + 1 - Influences are positive and the environment is affected within acceptable limits;

I_C = -1…0 - the influences are negative and the environment is affected beyond the allowed limits;

I_C = 0 -the state of the environment is not affected by the project

Table 4. Valuation notes for of the pollution indicators IC

NC	I_C	Effects on humans and the environment
10	0	- the environment is not affected by the projected activity
9	0÷0,25	- the environment is affected by the project within the admissible limits, level 1 - the effects are positive
8	0,25÷0,5	- the environment is affected by the project within the admissible limits, level 2 - the effects are positive
7	0,5÷1,0	- the environment is affected by the project within the admissible limits, level 2 - the effects are positive
6	-1,0	- the environment is affected by the project above permitted levels, level 1 - the effects are negative
5	-1÷-0,5	- the environment is affected by the project beyond the admitted level 2 - the effects are negative
4	-0,5÷-0,25	- the environment is degraded, level 1 - the effects are harmful at long exposure times
3	-0,25÷-0,025	- degraded environment, level 1 - Effects are lethal at average exposure times
2	-0,025÷-0,0025	- the environment is degraded, level 2 - the effects are harmful at average exposure times
1	<-0,0025	- the environment is degraded, level 3 - the effects are harmful at short exposure times

4.3 GLOBAL IMPACT ASSESSMENT

The Ipg Global Pollution Index is established on the basis of an analytical quantitative method, making the ratio between the ideal state and the real state.

If: $I_{PG} = 1$ - there is no pollution:

$I_{PG} > 1$ - there are environmental quality changes.

4.4 ENVIRONMENTAL IMPACT ASSESSMENT DURING THE EXECUTION PERIOD

4.4.1. Impact assessment based on pollution indices Ip

For the AER environmental factor the concentrations resulting from the execution are estimated as follows (Table 5):

Table 5. Estimated Gases Emitted in the Atmosphere and limits thereof

Source	pollutant	C_{max} 30min	CMA 30 min
Construction	Suspension particles	457	500
Gases of	Particles	31,59	500
	$SO_x(SO_2)$	3,81	750
	$NO_x(NO_2)$	58,64	300
	CO	45,76	6000
	COV_m	68,64	-

4.4.2 Overall impact assessment during execution

Notes of creditworthiness during the execution period (Table 6)

Table 6 .Credit scores during the execution period

Factor	Note of creditworthiness
Air	8
Human settlements	7
Water	6
Soil	6

Overall impact on the environment Ipg = 2.57

The environment is subjected to human activity producing a state of discomfort in life forms.

The necessary measures are to observe the technology of execution, the protection of the neighbouring areas, the accidental leakage of oil from machinery and means of transport.

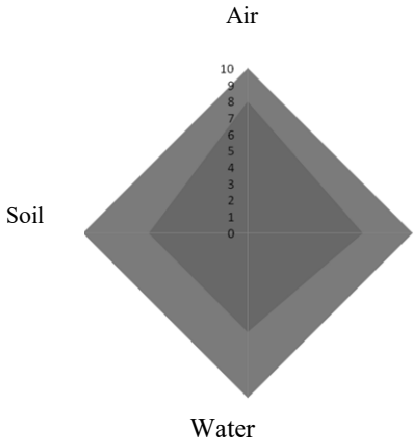

Figure 2. Diagram of the pollution index during the execution period

4.5 EVALUATING THE OVERALL IMPACT DURING THE EXPLOITATION PERIOD

Notes of creditworthiness during the period of operation are in Table 7

Table 7 Notes of creditworthiness during the period of operation

Factor	Note of creditworthiness
Air	9
Human settlements	8
Water	8
Soil	10

In conclusion, the environment is affected during the exploitation period within the permissible limits. The impact is low.

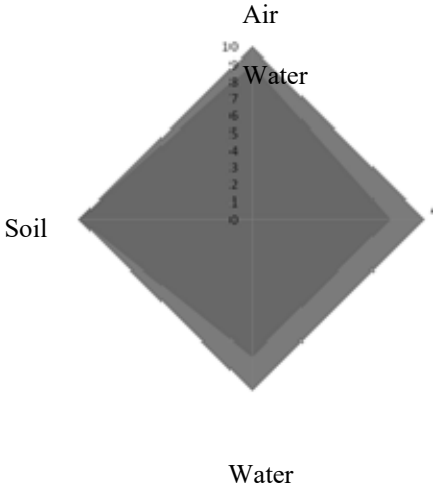

Figure 3. Graph of the pollution index during the exploitation period

4.5 POSSIBILITIES TO MITIGATE OR ELIMINATE THE ENVIRONMENTAL IMPACT

The sewage plant technology is performing, the machines are reliable, and automation of machine operation throughout the station has been provided.

From the sanitary point of view, to protect the area from disagreeable odours resulting from fermentation processes (ammonia, hydrogen sulphide, mecapthane, etc.), protection curtains are provided in plantations. Pollution from smell is reduced by the technological process:

- stabilization of the sludge by aeration;
- dehydration of sludge;
- disinfection of wastewater with ultraviolet.

5. CONCLUSIONS

The elaborated project solves in a good manner, the sewerage and sewage treatment of Teliuc locality.

The technical solutions adopted are related to economic, social and environmental protection.

During the execution period

ENVIRONMENTAL FACTOR WATER - During the execution period the water factor is polluted only to a small extent, being affected in particular by the underground waters due to the low water level

AIR ENVIRONMENTAL FACTOR - during the execution period, the only pollutant affecting the air is the exhaust gases which affect the environment to a small extent.

THE ENVIRONMENTAL FACTOR HUMAN DISPOSAL - during the execution period the human settlements are affected by the traffic of the machinery and the noise produced by them.

ENVIRONMENTAL FACTOR The Soil - is affected due to scraping and digging, but is affected for a short period of time.

In the operating period

Environmental factor water pollutant concentrations in treated waters do not exceed the limits allowed for exhaust. Impact on wat is low.

Air environental factor concentrations of pollutants in emission are below permitted limits, aer factor is affected within acceptable limits. The impact is low and strictly local.

The environental factor human disposals - human settlements are affected at a low level in terms of pollutants and noise levels.

Soil environental factor Not affected during operation

The designe objective complies with environmental and hygiene standards.

Waste water fom the small industry must meet NTPA 002/05 requirements, and if they exceed the admissible limits, they will be subjected to pre-treatment processes before being discharged into the sewerage network.

Operation of dcanters can be done at a 0.5 hour settling time, recommended by European Standards ATV 131/91 [5]. By this measurement in the biological stage optimal feeding conditions (fecal organic matter) of the microorganisms necessary for nitrification will be ensured.

The equipment for the sewage plant must be efficient, provided by established units.

The project will monitor the quality of drinking and domestic waters through periodic measurements and analyses to fit the projected parameters. The emissions will be monitored in the protected area.

Vegetable protection curtains will be created inside the station.

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